Chapter 6

AIR POLLUTION AND ABSENTEEISM: EMPIRICAL RESULTS

Absenteeism. One must remember that the calculated required compensations in Chapter 5 refer solely to situations in which the picker chose to work as long as he was permitted: he did not choose to adjust to the presence of air pollution by taking more leisure. Does he sometimes take more leisure when air pollution is high? If so; the required compensations presented in Tables 5.6 and 5.9 will be excessive if extrapolated to circumstances in which pickers do occasionally voluntarily choose leisure as a mode of adaptation. As (12) of Chapter 4 implies, for leisure to be chosen, its marginal utility must exceed the marginal utility of the earnings the picker could have obtained by continuing to work. Although the picker suffers disutility from the loss of earnings consequent upon his decision not to work, he also acquires some positive utility by having more leisure available. The compensation he requires to return to his original utility level in the presence of air pollution is therefore less than if he were to suffer 3 similar loss in earnings but still work the same number of hours he would without air pollution.

The model presented in Chapter 4 readily captures the additional dimension of the picker's voluntary taking of leisure as an adaptation to the presence of air pollution. Remembering that $H \equiv H^{+} - Z$, upon rewriting (14) in the standard form for a labor supply function one obtains

(15) $Z = H^{+} - H(I_t,$ air pollution, other factors that shift S in Figure 4.2 (b))

Given that environmental conditions help to determine the hours the picker chooses to work, a regression specification of Z on crew-hours and the factors determining the hours the picker works yields an estimate of the covariation between the hours the picker chooses not to work when he could have worked and the level of air pollution. Note that in (15), if air pollution actually influences the picker's decision, the dependent variable Z, the hours the picker chooses not to work, and the level of air pollution are expected to vary directly with one another.

Because of the myriad of factors which may enter into the picker's decision not to pick and which are unrepresented in (15), we cannot hope to achieve a particularly high degree of explanatory power. Of course, to the extent air pollution is a relevant explanatory variable and is uncorrelated with excluded but relevant explanatory variables, explanatory power is of no importance. The air pollution coefficient will still be unbiased and that is all that matters for our purposes.

In order possibly to reduce the extent tc which relevant variables that are nonorthogonal to the air pollution variable are excluded from attempts to estimate (15), the estimates appearing in Table 6.1 include observations during which the picker worked less than two hours. They do <u>not</u>, however, include observations in which the picker chose not to appear for work at all. Thus the, results should be interpreted as showing the picker's propensity to wbrk a lesser number of hours than his crew worked on a particular day, given that the picker chose to work for at least some time during that day. Regressions run with observations included in which the picker chose not to work at all gave results in which much less than one percent of the variation in Z was explained (for two pickers the $\bar{R}^2$'s were negative) and the F-tests for the entire expression were always less than unity. Air pollution coefficients were never statistically significant. The somewhat better robustness of the estimates appearing in Table 6.1 can plausibly be attributed to the greater number of factors (family illness, vacation plans, etc.) influencing the decision not to appear' for work at all as opposed to the factors influencing the decision to quit picking and undertake leisure after having already expended picking effort on a particular day. Available data limited the absenteeism estimates to Upland lemon pickers.

The estimates appearing in Table 6.1 are certainly not encouraging if one initially suspected that pickers adapt to air pollution by substituting leisure for picking effort. Any discouragement can, however, be tempered by at least three 'factors that might have influenced the character of the estimates. First, the pickers whose work ycrformnnccs are reported in this study were all deliberately selected because of their long and more-or-less continuous wbrk records. In short, these pickers tend on a day-to-day basis to persevere

Table 6.1

Absenteeism Estimates by Ordinary-Least-Squares for Upland Lemon Pickers.[a] Dependent Variable = Z.

Picker: Variable	Upland 1 (1973)	Upland 1 (1974)	Upland 2 (1973)	Upland 2 (1974)	Upland 3 (1973)	Upland 4[b] (1973)	Upland 22 (1974)
Constant	-0.409	-0.183	-0.650	-0.616	1.149	1.854	-2.942
	(1.124)	(0.678)	(0.566)	(0.999)	(0.927)	(1.706)	(1.215)
w	0.052	-0.041	0.114	-0.124	0.108	0.027	0.030
	(0.047)	(0.060)	(0.023)	. (0.105)	(0.043)	(0.081)	(0.145)
H^+	0.073	0.054	0.076	0.067	0.110	0.091	0.224
	(0.024)	(0.013)	(0.013)	(0.022)	(0.022)	(0.042)	(0.026)
FR	-0.002		-0.003	0.003	-0.010	-0.008	0.002
	(0.003)	(0.001)	(0.004)	(0.002)	(0.003)	(0.005)	(0.003)
BT	-0.008	-0.034	0.0001	-0.221	-0.016	-0.199	-0.427
	(0.047)	(0.116)	(0.0001)	(0.185)	(0.038)	(0.098)	(0.240)
ØZH	-0.012	0.003	0.006	0.004	0.009	0.018	0.007
	(0.012)	(0.005)	(0.006)	(0.008)	(0.011)	(0.019)	(0.009)
TM	0.003	-0.001	0.004	0.003	0.002	0.011	0.007
	(0.008)	(0.005)	(0.004)	(0.005)	(0.006)	(0.012)	(0.006)
TR	0.181	0.135	0.070	0.283	0.147	-0.048	0.403
	(0.131)	(0.125)	(0.066)	(0.197)	(0.106)	(0.172)	(0.264)
I_{t-1}	0.006	0.008	0.008	-0.018	-0.019	-0.063	0.048
	(0.018)	(0.010)	(0.008)	(0.016)	(0.021)	(0.032)	(0.025)
$\bar{R}^2$	0.042	0.105	0.213	0.057	0.218	0.148	0.372
S.E.	0.818	0.428	0.470	0.619	0.653	0.989	0.737
F	2.01	3.54	7.91	2.25	6.54	3.82	12.56
D-W	1.95	2.18	2.18	2.14	2.13	1.70	1.90
Sample Size	186	174	205	168	160	131	157
Sample Period	Mar. 17-Dec. 21	Apr. 1-Nov. 2	Mar. 19-Dec. 21	Apr. 1-Nov. 2	Mar. 17-Dec. 20	Mar. 16-Dec. 21	Apr. 17-Nov. 2

Table 6.1
(continued)

[a] These estimates include observations in which the picker worked less than two hours.

[b] This picker is a woman.

(The numbers in parentheses refer to the standard errors of the estimated coefficients).

in citrus harvesting, Perhaps pickers who, relative to the population of pickers, exhibit greater perseverance in their day-to-day piclcing activities will exhibit similar tenacity within any single day.

Second, the values of the air pollution and temperature variables used in Table 6.1 are those employed in all earlier tables; that is, they are the arithmetic mean ambient pollution concentrations and temperatures over the crew's work-day rather than the picker's work-day. Thus, on those occasions where Z is positive, pollution concentrations and temperatures occurring when the picker was taking leisure are included in the observed values of the pollution and temperature variables. The use of the latter values would be justified if and only if the picker's expectations about future pollution and temperature concentrations during the rest of the crew's work-day were always realized. This seems unlikely. It is therefore preferable to presume that the picker formulates his expectations about air pollution and temperatures for the rest of the work-day on the basis of the pollution and temperature levels he has already experienced. The values employed for estimation purposes should therefore have been some combination of pollution and temperature levels occurring while the picker was actually working. The failure to do so in the estimates of Table 6.1 means that the air pollution and temperature variables include measurement error and that their coefficients are therefore biased. The direction of bias for either coefficient is not immediately evident, particularly since the errors for these two somewhat collinear variables probably interact in a complex way.[1]

Third, in contrast to the earnings estimates of Chapter 5, no attempt was made for the absenteeism estimates to experiment with the empirical specifications for one or two pickers. That is, no effort was expended to gain insight into the absenteeism relationship by learning from the empirical results for "test" pickers. The estimates appearing in Table 6.1 are the first absentee estimates attempted for each picker.

In summary, the results presented in Table 6.1 make it easy to reject the maintained hypothesis that air pollution influences picker absenteeism. This rejection must, however, be highly conditional because of the character of the pickers for whom estimates were made, because of the inclusion of air pollution levels occurring after the picker had chosen leisure, and because no experimentation on "test" pickers was performed.

Simultaneous Adjustments of Work-Effort and Leisure. The model of the picker's decision problem prcsrnted in the Fourth- chapter implies that the picker, when faced with actual or expected air pollution, may adjust his work-effort, his leisure-time, or both. In the section immediately preceding this one and in Chapter 5, empirical tests of the model were undertaken, but no effort was made to estimate expressions in which the picker was permitted to adjust simultaneously his work-effort and his leisure. Thus no account has been taken of circumstances in which the picker suffered reduced but still positive productivity during part of his work-day, and, perhaps in response to this reduced productivity, then decided to substitute leisure for additional expenditure of picking effort. Nevertheless, the model of the picker's decision problem would seem to lend itself readily to simultaneous treatment o the influence of work-effort and voluntarily taken leisure-time upon earnings, or the influence of earnings and work-time upon voluntarily taken leisure-time All one need do is replace Z on the left-hand side of (15) with $H^+ - H$; substitute the H(.) of (15) into the II of (14), and state the resulting expression in stochastic form. The resulting or "reduced-form" expression is overidentified, however, meaning that one cannot allocate the estimated coefficients of the reduced form between (14) and (15), the original structural expressions. The air pollution coefficient should nevertheless provide an estimate of the combined effect upon earnings of work-effort and voluntarily taken leisure-time.

Following the procedures outlined in the above paragraph, we have estimated reduced-form expressions by two-stage-least-squares for two pickers, Upland 2 (1974), and Upland 22 (1974). In both cases,, earnings, I_t, was the dependent variable, i.e., expression (15) was substituted into expression (14). Without further analysis, the results cannot be considered enlightening. The highly statistically significant but positive air pollution coefficients obtained with the reduced form have thus far defied interpretation. Time has not permitted a detailed investigation of what may be causing these positive coefficients. .

Footnotes: Chapter 6

1. Additional remarks on the nature of the bias introduced are available in Anderson and Crocker (1971, p. 174).

Chapter 7

CONCLUSIONS AND FEASIBLE EXTENSIONS

Conclusions. Whenever one constructs a formal model of a real situation, one is attempting to express in an internally consistent manner a conviction as to which of the elements of the situation are trivial and which are essential. A bounded rationality requires that one pick and choose. It is a commonplace of statistical inference that one's convictions about the essential elements can, by comparing their implications with observations on real situations, be rejected but never completely accepted. The best one can do is fail to reject the convictions. It is worth noting, however, that even a rejection must rest upon some self-convincing interpretation of one's observations. The pressures of uncertainty operate symmetrically.

In order to secure the reality of citrus picking in the presence of air pollution somewhat more closely, a model of the picker's decision at the beginning of each day of whether or not to pick citrus and his supply of work-effort once he has decided to pick has been constructed. In the model, the response of work-effort to air pollution was viewed strictly as a biological relation: that is, air pollution entered the picker's production function for citrus fruit but it did not enter his utility function. The response was, in essence, viewed as a short-term and reversible morbidity effect. NO attempt was made to capture any long-term and irreversible effects. Certainly neither the model nor its empirical implementation captures all features that may influence the individual picker's work performance each 'and every day. For example, in addition to disliking the loss in earnings that the presence of air pollution causes, he may also dislike air pollution in and of itself. Nevertheless, the essential features of the determinants of the individual's day-to-day earnings from the picking of citrus fruit, appear, for the most part, to have been captured, both analytically and empirically.

The decision agent of the model, the individual citrus picker, corresponds exactly to the decision agent in each of the empirical analyses. It should be recognized that the study does not consist of a single empirical analysis of a collection of decision agents, but rather of a series of analyses, one analysis to each of eighteen pickers distinguished by individual, crop, or year. This series of analyses involved the consistent application of the identical analytical model to each picker. Although data did not permit explicit investigations of the reasons for differences among pickers in their responses to the presence of air pollution, these responses were consistently of the same order of magnitude.

With the exception of four "preliminary test" pickers, the basic model was empirically applied only once to each picker, thus avoiding the often difficult-to-interpret effects upon subsequent tests and estimation procedures of the "data-grubbing" or "massaging" techniques so frequently employed in similar studies.[1] Given the resources and time available to the study, this procedure was not without its costs, however. For a few pickers (in particular, all three of the Irvine orange pickers and the two Upland orange pickers), the stochastic statement of the model was clearly misspecified. The obvious way to repair this is to respecify in a correct fashion the expressions to be estimated for these pickers, and then apply these expressions to the data for new pickers drawn from the same crews. We possess the requisite data, but it has not been put in a form susceptible to computer treatment. Moreover, if we had investigated in detail the sources of the misspecifications for the Irvine and Upland orange pickers, we would have drawn available resources away from applying the estimated expression for the four preliminary test pickers to additional pickers in locales and for crops where the expression appeared to be robust. In our judgment, the application of the expression for the four preliminary test pickers to more pickers appeared more valuable to the study than correction of the misspecifications for the Irvine and Upland orange pickers.

The analytical model developed in Chapter 4 explains both the picker's decision whether or not to pick each day as well as his decision about how much effort to put forth once he has decided to pick. Only the latter aspect of arithmetic mean is established by weighting each picker by the number of observations for him in a crop or year. In terms of absolute dollar magnitudes, these compensating surpluses appear to range from less than twenty dollars to nearly two hundred dollars over an entire calendar year, given the piece-work wage rate scales and the levels of air pollution prevailing in the South Coast Air Basin during 1973 and 1974.

In addition to estimates of the compensating surplus for a number of pickers, two attempts were made to estimate the effect of air pollution upon the picker's substitution of leisure time for picking effort. One set of estimates presumed that while still picking, the picker did not adjust his picking effort. No statistically significant impact of air pollution upon the substitution of leisure time (absenteeism) for picking effort was discovered. It is possible this lack of significance is due to the fact that all the pickers tested had stable work histories, that the measure of air pollution employed covered the crew's work-day rather than just the period during which the picker in question was working, or that the statistical procedures employed were unsuited to the problem. No attempt has been made to ascertain whether any of these factors have influenced the estimates for absenteeism.

A second set of estimates tried to treat simultaneously the picker's reduction of picking effort during a single work-day and his outright substitution of leisure time for picking effort. Few research resources were devoted to this treatment, and the results obtained were not susceptible to immediate interpretation.

In summary, the results of the study provide quite strong evidence that citrus pickers would hnve had to be compensated by about two percent of what their incomes would have been in the absence of air pollution in order to be indifferent to the air pollution levels prevailing in the South Coast Air Basin in 1973 and 1974. This presumes that pickers did not reduce the hours they spent picking citrus fruit in response to these air pollution levels. Although much more tenative than the preceding estimates of required compensations, estimates of the responsiveness of absenteeism to air pollution during the same period were statistically insignificant. Thus, for the pickers studied, required income compensations averaging about two percent of picking earnings are quite accurate, given that air pollution did not influence absenteeism.

Feasible Extensions of this Research. The research possibilities residing in this data set are by no means exhausted. One might, in fact, map out a lengthy research program consuming several man-years of effort. No attempt is made in this section to do so; nevertheless, as embodied in this report, the study is somewhat incomplete. In this section, work that can quite readily be done with the existing data set and analytical framework is briefly discussed. The section and the report conclude with an even briefer discussion of extensions requiring the acquisition of additional data and/or the development of an analytical framework capable of encompassing a greater range of phenomena.

Currently in our possession is the same information used for the pickers and individuals studied in this report for approximately an additional 350 pickers comprising about 220 distinct individuals. As this report is being written, the information for six of these pickers has been tabulated and keypunched but has not yet been submitted to the ministrations of the computer. In spite of the consistency of the results generally obtained across pickers, the small number of pickers and individuals studied (note, however, that a large number of observations were available for each picker), make one a bit hesitant to testify resoundingly that it has been definitively established that photochemical oxidants are detrimental to the work performance of citrus pickers. After all, fifteen or so replications of an experiement do constitute a small sample. Running the experiment for additional pickers would be a time-consuming task, but, given what has thus far been accomplished, mostly a mechanical one. In a letter to the project officer dated November 21, 1975, we stated that an analysis of about sixty pickers would be an adequate sample size. Clearly, this has not been accomplished.

Perhaps the most troublesome problem in discovering the statistical significance of the air pollution coefficients has been the collinearity between the air pollution and temperature variables. This collinearity is reflected in the considerable reductions in standard errors of the air pollution coefficients that frequently occur when the temperature variable is deleted from the expressions to be estimated. One obvious but as yet untried way possibly to reduce this collinearity is to partition each picker's data set by temperature intervals so as to lessen the variability of temperature.

This, of course, does not guarantee that the variability of air pollution might not be reduced as much or even more. The partitioning would have the additional advantage of providing a partial test of the hypothesis that nir pollution impacts vary with temperature levels.

A partitioning of the air pollution variable itself can provide information on whether the assumption used in this study of a constant elasticity of air pollution impact with respect to earnings is reasonable. The partitioning can also provide insight into the form of the relationship between earnings and air pollution, including whether there is some positive level of air pollution at which a negative impact of air pollution upon earnings begins. Some preliminary efforts along these lines for six pickers show no tendency whatsoever for the air pollution elasticity of earnings to increase with increasing air pollution levels. Some imagination and perhaps a bit of wishful thinking enables one to discern a slight tendency for the elasticity to decline with increasing air pollution.[2]

Only the arithmetic mean of the concentration air pollution during the crew's work-day or over a twenty-four hour period are used in this report as a measure of air pollution, although the variance of the air pollution distribution over the crew's work-day was introduced and found to be statistically insignificant for the four preliminary test pickers. Of course, the arithmetic mean and variance are not the only characterizations of the air pollution measure that might be relevant. For example, given the intuition of many familiar with the health impacts of air pollution that peak concentrations account for a disproportionate share of impact, a measure of skewness could also be relevant. In addition, it is plausible that within any given work-day the effect of air pollution is cumulative, requiring that one account for prior air pollution levels during the day via a distributed lag structure..

The speculations of the preceding paragraph suggest that characterizations of the air pollution variable in addition to its arithmetic mean might be relevant. No suggestion is made in analytical terms, however, as to why they might be relevant. An analytical framework Eor their relevance is readily provided in terms of the economics of uncertainty. By using the arithmetic mean of air pollution, we have implicitly and strongly assumed that the picker makes his picking decisions solely on the basis of the expected value of air pollution concentration. In short, certainty equivalence, with its implication that the concentrations the picker expects are always realized, has been assumed. The picker's behavior at any time is therefore viewed as invariant with respect to the probability of error in his forecast of expected air pollution dosages. It is readily shown that, independently of actual pollution dosages, the existence of the possibility of discrepancies between the picker's expected and realized air pollution dosages is costly in and of itself.[3] This study, as presently constituted, could therefore be neglecting a fairly important facet of the impact of air pollution upon citrus picker work performance. The air pollution measures of the previous paragraph would permit one to test for the existence and magnitude of this uncertainty effect without necessitating any fundamental changes in the analytical framework already employed in the study.

All expressions estimated in this study are based upon the assumption of an additive error term with the usual Gauss-Markov properties. Since the study is actually a series of analyses of the work histories of individuals, one analysis to an individual, this is not an altogether innocent assumption. It implies that the error for a picker during work-day t is independent of the error at t-l. Except for certain orange pickers, this assumption seems, in fact, innocent enough since Durbin-Watson statistics consistently hovered around 2.00. For tltesc orange pickers, however, the Durbin-Watson statistics were consistent with the presence of rather severe negative autocorrelation. There exist several possible responses to this presence, none of which have been applied to the orange pickers in this study. For example, one might, resort to maximum likelihood or two-stage-least-squares estimating procedures. Or there may be some neglected variable, such as lagged earnings, that has a systematic influence on the current earnings of orange pickers but has none upon the current earnings of lemon pickers. It would be a rather simple matter to designate as "preliminary test" workers -a couple of the orange pickers for whom expressions have already been estimated, experiment with their stochastic specifications, and then apply the resulting improved specification to additional orange pickers.

The stochastic expressions of the inverse supply function that have been estimated in this study have not embodied all the *a priori* information the analytical framework is capable of generating. For example, given that air pollution does not enhance the ability of the picker to harvest fruit, a few simple manipulations of the compensating surplus model of Chapter 4 will generate the conclusion that air pollution must affect picker earnings either not at all or negatively. This is a result of the inability of the picker to work for longer hours than does his crew and it implies the coefficient for the air pollution variable can be restricted to zero or negative values. It is possible that this knowledge about the sign of the air pollution coefficient would, if a restricted estimation technique such as the mixed estimation method of Theil and Goldberger (1961) is used, would reduce the variance of the air pollution estimator and thereby increase the efficiency of estimation.

The empirical sections of this study that attempt to estimate the relationship between air pollution and absenteeism, as well as the simultaneous relationship between air pollution, earnings, and absenteeism, are incomplete. As was indicated in the main text, any investigation of the simultaneity between earnings and absenteeism was set aside as soon as difficulties of interpretation were faced. If only because a full description of the picker's response to air pollution requires that account be taken of the possibility that he adjusts both work effort and leisure time during a single day, more thorough investigation of this simultaneity would be useful. As for absenteeism, again as was indicated in the text, a measure of air pollution that measures cumulative work-day exposures occurring prior to the picker's termination of work effort would be preferred to the air pollution measure actually employed. The use of this preferred measure might show some effect of air pollution upon absenteeism.

The discussion to this point in this last section of the report has dealt solely with additional research that can be done within the confines of the existing data set and analytical model. It was pointed out that opportunities are available to acquire greater confidence in the measured air pollution impacts reported here, to gain better understanding of the interactions between air pollution impact and factors such as temperature, and to delve further into the reasons why air pollution impacts for certain pickers and certain classes of relationships were not obtained. If one combines the existing data set with additional data and if one expands the analytical model, a number of further issues can be empirically investigated. For example, it would be most interesting to know why air pollution impacts appear to differ among individuals. If differences in biological endowments are the source, these differences are easily built into a slightly expanded version of the analytical model of Chapter 4. It would be a relatively easy matter to acquire information on such obvious sources *(or* proxies *for* sources) of differences as age, weight and height, and sex. A much more ambitious effort might involve interviews to acquire data on medical histories, life styles, and occupational histories. Acquisition of data of this sort would allow a pooled time series-cross sectional analysis capable of explaining the relationship between the disturbances of a specific picker population at two or more different times.

The reader familiar with the biomedical literature will have long ago noted that no mention is made anywhere in the previous pages of biomedical evidence of the effects of photochemical oxidants upon the human organism. Although a cursory review of the biomedical literature did not yield any studies that could bc employed as a priori information in this study, a more thorough review might provide such information. Biomedical information might, in fact, be particularly useful in specifying functions explaining the sources of differences in air pollution impacts among individuals, This information would be extremely valuable in a pooled time series-cross sectional study.

A final question perhaps of interest is the feasibility of extending the approach used here to other industries in order to study the effects of environmental pollutants upon labor performance. The data available to this study are certainly unusual to some degree because of their detail on the day-to-day pay scales, working conditions, and environmental conditions of individual workers. It is, in fact, difficult to think of another single industry for which similar detail would be available, in which the supply of worker effort is strongly separable from the efforts of other workers, and where complementary capital equipment is of no more than trivial import. In the absence of these conditions, the analytical model of the worker's supply of effort decision would be more complicated. This is not to say, however, that the model cannot be built, nor that the data is unlikely to be available with which to implement it empirically. For example, many firms in the construction industry and in agricultural industries monitor the output of individual workers and maintain records of the conditions under which they are working. Collection of the data is normal business practice. This is the only data required to implement some approximation of the approach taken in this study.

Footnotes: Chapter 7

1. It should be noted, nevertheless, that there exist orderly and rigorous techniques for inductive model-building that permit one to weigh the gains in improved specification against the losses in robustness of estimators. For an analysis of the properties of one of these techniques, see Wallace and Ashar (1972).

2. For more detail and a less cautious statement about these tendencies, see Crocker and Horst (1976).

3. For formal proofs and arguments showing this in pollution contexts, see Crocker (1971, pp. 21-26), and National Academy of Sciences (1974, pp. 427-470).

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16. ABSTRACT

This project assesses the effect of photochemical oxidants on the work performance of twelve individual citrus pickers in the South Coast Air Basin of southern California. A model of the picker's decision problem is constructed in which oxidants influence the individual's picking earnings and leisure-time via short-term and reversible morbidity effect. Circumstances are specified under which this effect can be interpreted as the additional earnings the individual would have to receive in the presence of oxidants in order to make him indifferent to the presence of oxidants, This Hicksian compensating surplus is estimated separately for each of twelve individuals. In terms of absolute dollar magnitudes, compensating surpluses appear to range from less than twenty dollars to nearly two hundred dollars over an entire calendar year, given the piece-work wage rate scales and the levels of air pollution prevailing in the South Coast Air Basin during 1973 and 1974. As a percentage of what individual earnings would have been in the absence of air pollution, the dollar magnitudes range from three-tenths of one percent to nine percent. The average is about two percent. All estimates of the compensating surplus are conditional upon the individual not adjusting the hours he picks in response to air pollution. Estimates give fairly strong support to the hypothesis that air pollution impact, measured in terms of the compensating surplus, tends to increase with increasing numbers of hours worked.

17. KEY WORDS AND DOCUMENT ANALYSIS

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